CLAIMS

1. Achromatic phase shift device for introducing a wavelength independent optical phase shift in a first optical beam during operation, comprising at least one dispersive element,

characterised in that

the at least one dispersive element comprises a first pair (55_0) formed by first refractive means (2) and second refractive means (4),

the first refractive means (2) having a first refractive means input plane (6) for receiving the first optical beam (40) and a first refractive means output plane (8), the first refractive means input plane (6) and the first refractive means output plane (8) being at a predetermined angle β to each other, $0 < \beta < \pi/2$,

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the second refractive means (4) having a second refractive means input plane (10) and a second refractive means output plane (12), said second refractive means input plane (10) being positioned equidistant to the first refractive means output plane (8) and the second refractive means output plane (12) being positioned parallel to the first refractive means input plane (6).

2. Device according to claim 1, **characterised in that** the device further comprises a plurality of k further pairs (55_k), k being an integer between 1 and M, each further pair (55_k) comprising respective first refractive means (2_k) and respective second refractive means (4_k),

the respective first refractive means (2_k) of each of the plurality of further pairs (55_k) having a first refractive means input plane (6) for receiving the first optical beam (40) and a first refractive means output plane (8), the first refractive means input plane (6) and the first refractive means output plane (8) being at a predetermined angle β_k to each other, $0 < \beta_k < \pi/2$,

the respective second refractive means (4_k) of each of the plurality of further pairs (55_k) having a second refractive means input plane (10) and a second refractive means output plane (12), said second refractive means input plane (10) being positioned equidistant to the first refractive means output plane (8) and the second refractive means output plane (12) being positioned parallel to the first refractive means input plane (6).

3. Device according to claim 2, **characterised in that** the respective first refractive means (2_k) of the plurality of further pairs (55_k) are positioned adjacent to each other, forming a first group, the respective first refractive means (2_k) in the first group being in physical contact.

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4. Device according to claim 2 or 3, **characterised in that** the respective second refractive means (2_k) of the plurality of further pairs (55_k) are positioned adjacent to each other, forming a second group, the respective second refractive means (2_k) in the second group being in physical contact.

5. ~~Device according to claim 3 or 4, **characterised in that** the respective first~~ and second refractive means (2_k, 4_k) of the plurality of further pairs (55_k) are positioned symmetrically on respective sides of the first pair (55_0).

6. Device according to one of the claims 2 through 5, **characterised in that** all of the first refractive means (2_k) and the second refractive means (4_k) of all of the plurality of further pairs (55_k) have a substantially equal refractive index (n_k).

7. Device according to one of the claims 1 through 6, **characterised in that** spaces between the first refractive means (2_k) and the second refractive means (4_k) of each of the first pair (55_0) and plurality of further pairs (55_k) are filled with a predetermined medium having a predetermined refractive index (n_0).

8. Device according to one of the claims 1 through 7, **characterised in that** the device further comprises first control means for moving the first refractive means (2_k) and the second refractive means (4_k) of at least one of the first pair (55_0) and the plurality of further pairs (55_k) with respect to each other, the direction of movement being perpendicular to a line of intersection of the input surface and output surface of the first refractive means (2_k).

9. Device according to one of the claims 1 through 8, **characterised in that** the first and second refractive means (2_k, 4_k) are formed by a first and a second prism (2, 4; 3, 5), respectively.

10. Device according to one of the claims 1 through 9, **characterised in that** the device (1) further comprises additional means (35, 36) of a dispersive material for applying a chromatic correction to the optical beam, in which the dispersive material has a refractive index which is different from a refractive index (n_k) of the first and second refractive means (2_k, 4_k) of the first pair (55_0) and plurality of further pairs (55_k).

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11. Device according to one of the claims 1 through 10, **characterised in that** the device (1) introduces a predetermined phase shift ψ_0 between the first optical beam (40) and a second optical beam (41), the second optical beam (41) running substantially parallel to the first optical beam (40) over an optical path length w_0, a first optical axis (50) being defined from a device input surface (51) to a device output surface (52), the first refractive means (2_k) having a first distance d_k' along the first optical axis (50) and the second refractive means having a second distance d_k'' along the first optical axis (50), the first optical beam (40) being at an angle θ_k with the first optical axis (50) and a modified refractive index a_k being defined as $a_k = n_k \cos \theta_k$,
in which the sum d_k of the first and second distance of the first and second refractive means (2_k, 4_k), respectively and the required optical path w_0 are determined by solving the following equations for the wavelengths ($\lambda_0 \ldots \lambda_M$) at which the predetermined phase shift ψ_0 should be obtained exactly:

$$\begin{array}{c}
-w_0 + a_0(\lambda_0)\, d_0 + \cdots\cdots + a_{M-1}(\lambda_0)\, d_{M-1} = \dfrac{\psi_0}{2\pi}\lambda_0 \\
\vdots \qquad\qquad \vdots \qquad\qquad \vdots \\
-w_0 + a_0(\lambda_M)\, d_0 + \cdots\cdots + a_{M-1}(\lambda_M)\, d_{M-1} = \dfrac{\psi_0}{2\pi}\lambda_M
\end{array}$$

12. Device according to one of the claims 1 through 10, **characterised in that** the device introduces a predetermined phase shift ψ_0 between the first optical beam (40) and a second optical beam (41), the second optical beam (41) running substantially parallel to the first optical beam (40) over an optical path length w_0, a first optical axis (50) being defined from a device input surface (51) to a device output surface (52), the

first refractive means (2_k) having a first distance d_k' along the first optical axis (50) and the second refractive means having a second distance d_k'' along the first optical axis (50), the first optical beam (40) being at an angle θ_k with the first optical axis (50) and a modified refractive index a_k being defined as $a_k = n_k \cos \theta_k$,

in which the sum d_k of the first and second distance of the first and second refractive means (2_k, 4_k), respectively, and the required optical path w_0 are determined by requiring constant terms and terms with $\lambda^2, \lambda^3, \ldots, \lambda^M$ to become zero and the term with λ to become equal to $\psi_0/2\pi$ in the equation for the introduced optical path length difference $w_d(\lambda)$ according to

$$w_d(\lambda) = -w_0 + \sum_{k=0}^{M-1} \{a_{k0} + a_{k1}(\lambda - \lambda_0) + a_{k2}(\lambda - \lambda_0)^2 \cdots\cdots\cdots\} d_k$$

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in which $a_{k0}, a_{k2}, \ldots$ = series expansion coefficients of the modified refractive index a_k, according to

$$a_k = a_{k0} + a_{k1}(\lambda - \lambda_0) + a_{k2}(\lambda - \lambda_0)^2 \cdots\cdots\cdots$$

in which λ is a wavelength of the optical beam (40) and λ_0 is a central wavelength of a predetermined spectral band.

13. Interferometer having a first input plane and a second input plane for receiving at least a first and a second optical beam and an interference plane for letting the at least first and second optical beam interfere, a first optical path being formed from the first input plane to the interference plane and a second optical path being formed from the second input plane to the interference plane,

comprising optical path delay means for introducing an optical path difference between the first optical path and the second optical path, **characterised in that** the interferometer further comprises at least one achromatic phase shift device according to one of the claims 1 through 12, positioned in at least one of the first optical path and the second optical path.

14. Interferometer according to claim 13, **characterised in that** an achromatic phase shift device is positioned in each optical path.

15. Interferometer according to claim 13 or 14, **characterised in that** the interferometer comprises main control means for maintaining the phase shift (ψ_0)

between the at least first and second beam at a predetermined value, the main control means being connected to the optical path delay means (26,27), and the first control means.

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16. Interferometer according to claim 15, **characterised in that** the predetermined value is equal to π.

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